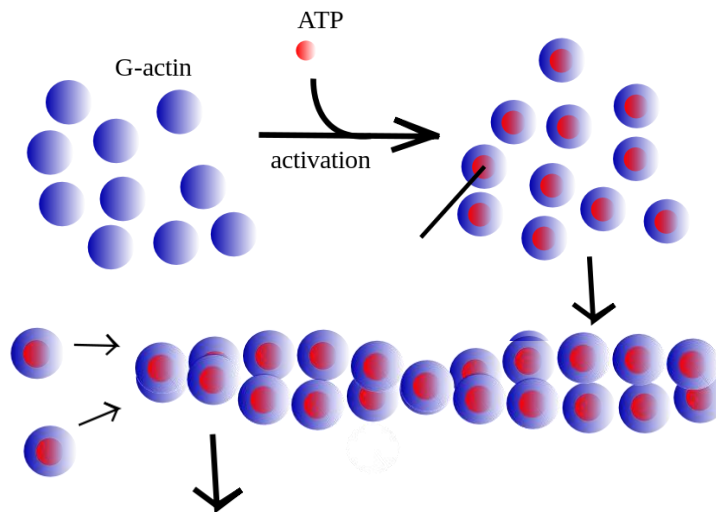


## CONCEPT: ACTIN FILAMENTS

### Structure

- **Actin filaments (microfilaments)** are cytoskeletal elements crucial for cell movements
  - **G actin subunits** are monomers that make up the larger actin filaments
    - **F actin filaments** are composed of two strands of G actin wound around each other
    - There are many types of actin (alpha = muscle; beta= nonmuscle; gamma = nonmuscle)
  - Position of actin subunits provide \_\_\_\_\_ to the F actin filaments
    - **Minus end** (*pointed end*) and **plus end** (*barbed end*)

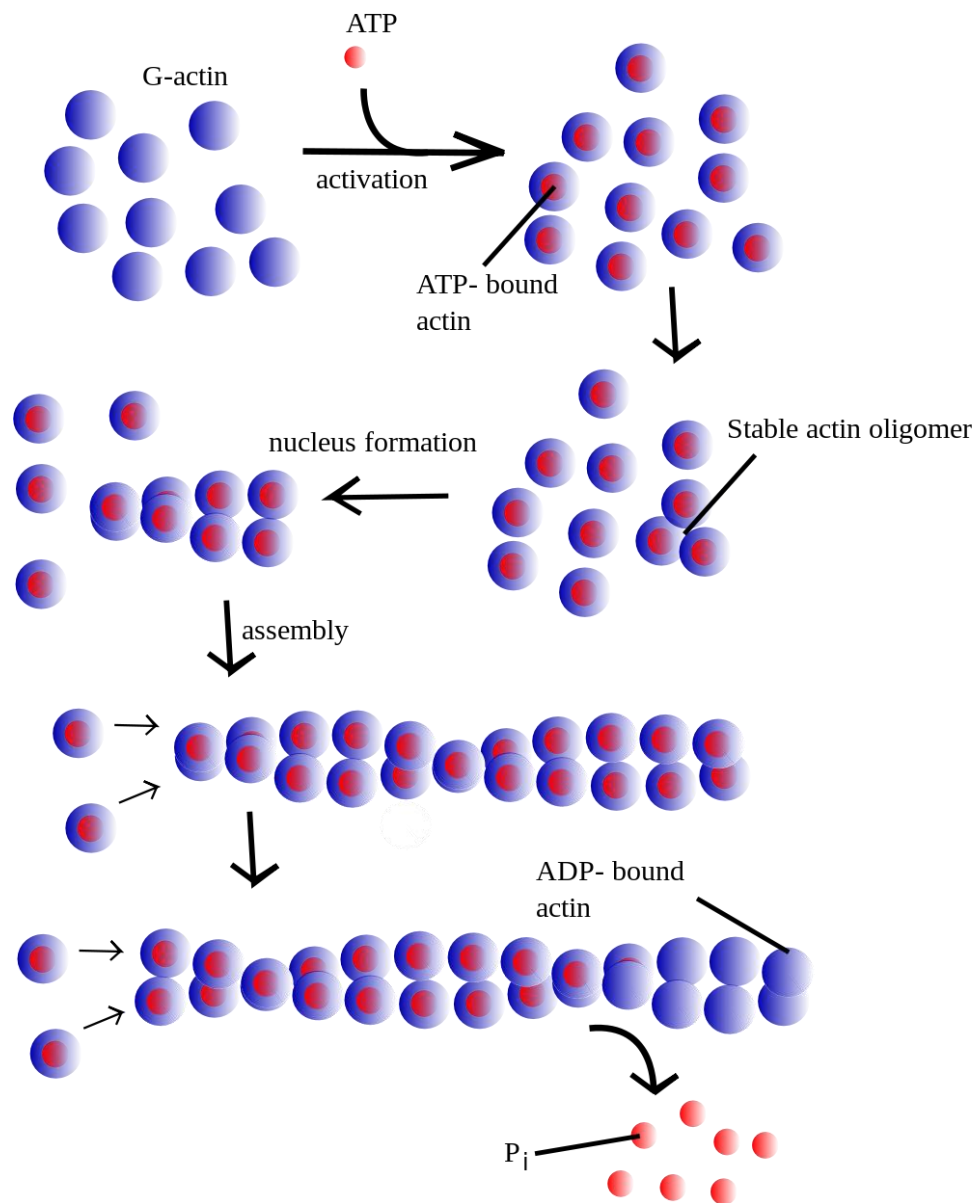
### **EXAMPLE:**



- Actin filaments polymerize \_\_\_\_\_ to that of microtubules
  - G actin monomer are added to each end
    - However, addition occurs faster at the *plus end* than the minus end
  - Each time a G actin monomer is added it hydrolyzes ATP shortly after addition
    - Hydrolyzed slowly: promotes filament growth
    - Hydrolyzed quickly: destabilization results in loss of actin polymers (minus end)
  - Also undergoes *dynamic instability* and *treadmilling*
    - **Dynamic instability** is the rapid switch from growth to shrinkage at plus end

- **Treadmilling** is the gain of monomers at the plus end and loss of monomers at the minus end

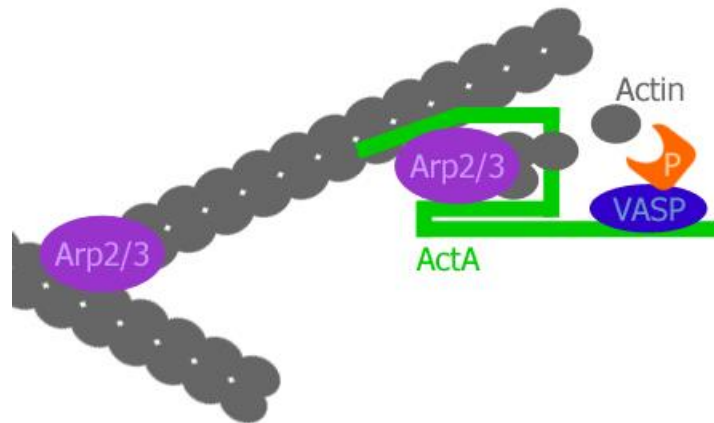
**EXAMPLE:**



## Associated Proteins and Organization

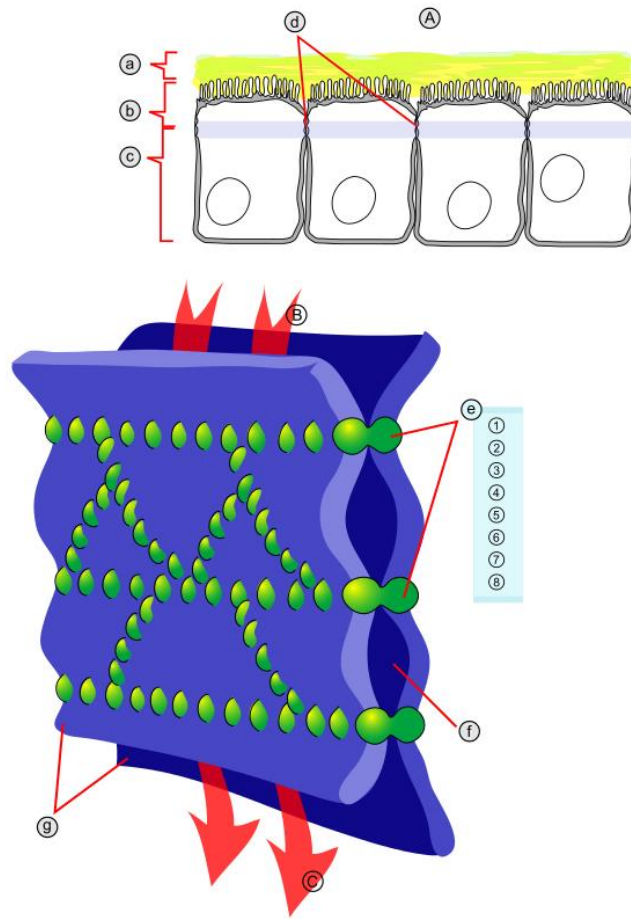
- Many proteins are associated with actin to assist in \_\_\_\_\_, and function
  - **Arp2/3 complex** and **formins** assist in *nucleation* which controls where actin filaments are formed
  - **ADF/Cofilin** binds to actin and enhances disassociation of ADP-actin
    - **Profilin** reverses this action, and stimulates addition of actin monomers into filaments
    - Hydrolyzed quickly: destabilization results in loss of actin polymers (minus end)
  - Proteins help regulate actin in many different ways
    - Ex: Regulate polymerization, cap actin filaments, crosslink, sever, bundle, attach actin

**EXAMPLE:** Arp2/3 promoting actin filament formation



- The cell organizes actin in a few distinct ways
  - **Actin bundles** form when actin filaments are cross linked into closely packed parallel arrays
  - **Actin networks** form with actin filaments are cross linked into orthogonal arrays
    - 3D meshwork is formed with characteristics like that of a semisolid \_\_\_\_\_
  - **Cell cortex** is composed of actin filaments and actin-associated proteins and lies beneath the plasma membrane
  - **Microvilli** are fingerlike extensions of the plasma membrane that are involved in absorption (made of actin)
    - Cells can have a **brush border** which is a layer of microvilli on the cell surface

**EXAMPLE:** Actin filaments supporting microvilli on the surface of plasma membrane



### PRACTICE:

1. Which of the following proteins are associated with actin nucleation?
  - a. Arp 2/3
  - b. ADF
  - c. Profilin
  - d. Integrin
2. True or False: Actin monomers are added to both the minus end and the plus end of a growing actin filament?
  - a. True
  - b. False

3. Which of the following terms describes the addition of monomers at the plus end and the loss of monomers at the minus end?
- a. Dynamic instability
  - b. Treadmilling

4. If ATP at the minus end is hydrolyzed quickly, what happens to an actin filament?
- a. The filament grows at the minus end
  - b. The filament is destabilized at the minus end
  - c. The filament grows at both the minus and plus ends
  - d. The filament is destabilized at both the minus and plus ends